

01929

1995/12/00



Defense Intelligence Reference Document


Foreign Oceanographic Research and Development with Naval Implications - China (U)

Information Cutoff Date: 31 December 1995

This is a Department of Defense Intelligence Document
Prepared by:



This product responds to DIA Task number PT-1820-02-01L



ONI-1821-00'

(Reverse Blank)

[REDACTED]

Foreign Oceanographic Research and Development with Naval Implications - China (U)

Executive Summary

(C) China's ocean sciences infrastructure is composed of State controlled civilian and military organizations whose goal is continued advancement in a wide range of ocean-related research and development (R&D) fields [REDACTED]

As China's Gross National Product (GNP) continues to grow, the resources needed to further their priorities in science and technology (S&T) will become available.

[REDACTED]

[REDACTED]

(S) [REDACTED], Project 211, designed to upgrade and strengthen the top 100 institutions of higher learning, will be supported by two of the organizations from the defense industry, COSTIND and CSSC [REDACTED]

[REDACTED]

(S) [REDACTED] The CAS Institute of Acoustics has been concentrating on shallow water acoustics for many years.

Information Cutoff Date: 31 December 1995

[REDACTED]

ONI-1821-001-96

[REDACTED]

[REDACTED] Most of China's ocean-related efforts have involved shallow coastal waters, but there is evidence of growing interest in the open ocean. Other militarily significant fields under study by the PRC include fiber optic hydrophones, parametric sonar, ferrofluid transducers, and digital technology.

[REDACTED]

(U) [REDACTED] The indigenous supercomputer, the YH-II is currently used as the computing platform for medium-range numerical weather prediction. [REDACTED]

[REDACTED]

(U) During the early 1990s, China made public its overall funding for S&T programs which showed an increase in its outlay for S&T from 0.7 percent of its GNP to 1.0 percent. Since the 21st century estimates suggest a further increase in China's GNP, increases in funding for S&T research is expected to continue.

Contents


| | |
|---|-----|
| Executive Summary (U) | iii |
| Section I Introduction (U)..... | 1 |
| Section II National Level Ocean Sciences Infrastructure (U) | 3 |
| Section III Oceanographic Research (U)..... | 11 |
| Underwater Acoustics (U)..... | 11 |
| Physical Oceanography (U) | 11 |
| Chemical Oceanography (U)..... | 13 |
| Biological Oceanography (U) | 14 |
| Geological Oceanography (U) | 14 |
| Marine Meteorology (U) | 14 |
| Section IV Remote Sensing (U) | 15 |
| Section V PRC Research Ships and Operations (U) | 19 |
| Section VI Ocean Modeling (U)..... | 21 |
| Section VII Ocean Sciences Data, Instrumentation and Technology Transfer (U) | 23 |
| Ocean Sciences Data (U) | 23 |
| Instrumentation and Technology (U) | 23 |
| Technology Transfer (U)..... | 24 |
| Section VIII International Cooperation and Exchange Programs (U)..... | 25 |

Appendix

| | |
|---------------------------------------|-----|
| A. Known PRC Research Ships (U) | A-1 |
|---------------------------------------|-----|

Tables

| | |
|---|------------|
| 1. Organizations with Affiliated Marine Institutions (U) | 6 |
| 2. Ocean Sciences Related State Key Institutions (U)..... | 6 |
| 3. Chinese Society of Oceanography (U) | 7 |
| 4. Chronology of Organizational Ocean Sciences Events (U) | 8 |
| 5. PRC Ocean Acoustics Personalities (U)..... | 12 |
| 6. PRC Ocean Remote Sensing Organizations and Personalities (U) | 16 |
| 7. [REDACTED] | [REDACTED] |
| 8. International Cooperation and Exchange: Selected Marine Science Institutions of China (U) | 25 |



Contents (Continued)

Figures

1. Ocean Sciences Research and Development Organizations (U)..... 4
2. Ocean Sciences Organizations in Coastal Fleet Regions (U) 5
3. PRC Marine Scientific Research Methodology (U). 19



Section I

Introduction

(U) China recognizes the important links between a strong economy, advanced technology and national security. China's move toward an increasingly open and market-based economy has been successful in attracting needed foreign investment and access to new technology. Rapid economic growth in turn is providing the means for China's acquisition of a wide range of commercial and technological assets, including selected military technologies.

(U) Continuing success in economic reform and improvements in the living standard for the world's most populous country requires an expanding resource base. As early as 1978, a marine science delegation from the People's Republic of China (PRC) visited the United States for the purpose of obtaining technological information and promoting foreign trade.

(U) China seeks to become a global policymaker with regard to maritime and natural resources issues. These include dwindling fish stocks, offshore oil and gas, deep-sea minerals, aquaculture and seawater utilization. Their goal was demonstrated when the PRC set up an official scientific research station in Antarctica in 1984/85. The People's Liberation Army Navy (PLA Navy) provided important support for the expedition which was nominally headed by the National Bureau of Oceanography (NBO).¹ After becoming an Antarctic Treaty Contracting Party in 1985, China acquired full voting rights in decision-making regarding Antarctic issues.

(U) In addition to natural resources, other issues driving the development of China's ocean sciences program include national security, global commerce and environmental concerns. The interplay among these factors is complex and evolving.

(U) China's coastal environment is experiencing widespread and unprecedented changes. These changes suggest a loss of stability and biological diversity for one of the world's most productive ecosystems, including bays, estuaries and lagoons. The environmental stress caused by the rapid industrialization of China's extensive coastal regions calls for the implementation of corrective measures. China is developing environmental regulations supported by satellite and airborne remote sensing to control and monitor large coastal ocean regions.

(U) China's desire for access to various commercial, trade and financial organizations in the international community requires greater openness in its national policies. Thus, in 1990, China made public, for the first time, its overall funding of science and technology (S&T). China plans to increase its outlay for S&T from 0.7 percent of its gross national product (GNP) in 1990 to 1.0 percent in 1995. A further increase is projected by the year 2000. These increases take on even greater significance with a rapidly expanding GNP. Part of this increased funding is devoted to setting up and maintaining a network of basic research laboratories, a number of which are to be ocean-related.

¹ (U) The change in designation from NBO to State Oceanic Administration in 1985 is likely an indication of the importance of marine science in China's national development strategy.

Section II

National Level Ocean Sciences Infrastructure (U)

(U) Initiatives are being taken to move China into the ranks of the top ten scientific and technical (S&T) global powers by the year 2010. These initiatives include reform and restructuring of China's research and development (R&D) infrastructure to include downsizing, spin-off of market-oriented enterprises, and innovative R&D structures. Maritime-related organizations certain to be affected by this reform include defense, environmental monitoring and management, resource exploration, and commercial activities (Figure 1). Despite the attempts to reform and reorganize each of these areas, the guiding role of the state is certain to continue.

(U) The organization primarily responsible for basic R&D in China has historically been the Chinese Academy of Sciences (CAS), whose major mission involved natural science policy and research and military-related R&D. Key CAS institutes dedicated to that mission are the Institute of Oceanography, Qingdao; the South Sea Institute of Oceanography, Guangzhou; and the Institute of Acoustics, Beijing. Within the framework of the present reform, the focus of the work of many CAS scientists and technicians will change from basic R&D to more applied market-oriented technology by the year 2000. Such streamlining should not weaken the essential research capability of the CAS institutes, but strengthen their attempt to develop the research into marketable commodities.

(U) The most recent example of reform in China's S&T infrastructure occurred in 1993, when the State Science and Technology Commission (SSTC) assumed responsibility for the State Oceanic Administration (SOA). This change allows the SSTC to more effectively consider marine issues as it implements its national R&D strategy. The mission of the SOA is marine resource management and monitoring. The SOA operates major institutes in Qingdao, Hangzhou, Xiamen, Tianjin and

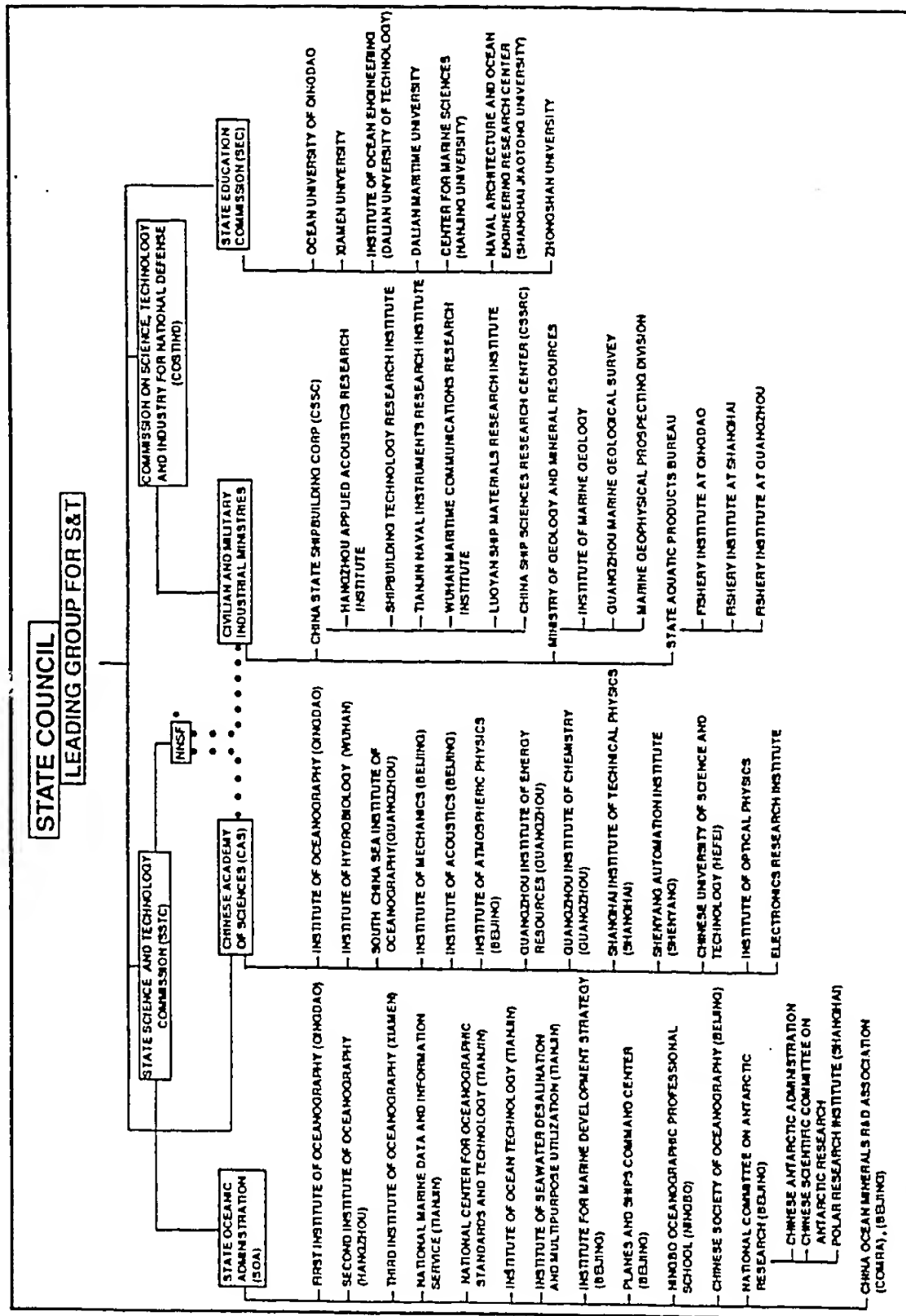
Beijing. The geographic distribution of its North, East and South Sea branches approximately parallels the locations of the North, East and South coastal fleets, suggesting at least a past connection between the SOA and People's Liberation Army Navy (PLA Navy) (Figure 2 and Table 1).

(U) China's primary organization for defense-related R&D is the Commission on Science, Technology and Industry for National Defense (COSTIND). COSTIND engages in a wide range of defense-related activities while linking the civilian and military sides of the industry.

COSTIND has its own universities and even a large commercial enterprise in the Shenzhen Special Economic Zone. A defense S&T committee under COSTIND has been working on a long-term weapons R&D program.

(U) China's R&D reforms extend to the higher education sector as well. Project 211 is designed to upgrade and strengthen the top 100 institutions of higher learning. COSTIND and the CSSC will be supporting ten such institutions from the defense industry, including the Harbin Shipbuilding Engineering Research Institute. This institute recently did research on an analytic method for measuring underwater acoustic transducer performance and a new underwater acoustic communication system. Ocean University of Qingdao, the only Chinese university authorized to grant degrees in advanced ocean sciences, is also likely part of Project 211.

(U) A potentially dramatic change in China's long-term



* NATIONAL NATURAL SCIENCE FOUNDATION

Figure 1. (U) Ocean Sciences Research and Development Organizations

UNCLASSIFIED

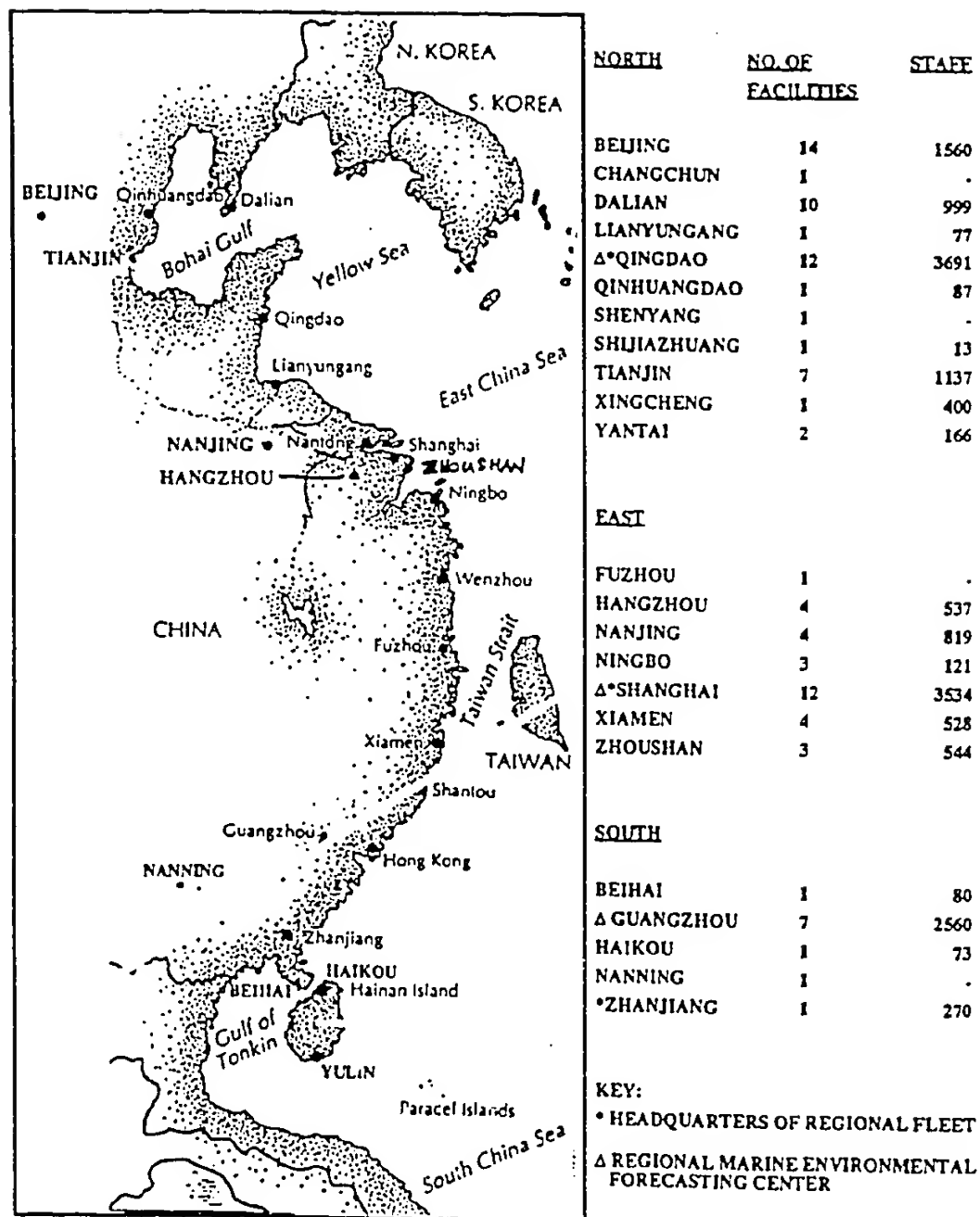


Figure 2. (U) Ocean Sciences Organizations in Coastal Fleet Regions

UNCLASSIFIED

Table 1. Organizations with Affiliated Marine Institutions

| Organization | No. of Locations | No. of Facilities | Staff |
|---------------------------------------|---------------------|----------------------|-------|
| State Oceanic Administration | 9 | 24 | 4832 |
| Chinese Academy of Sciences | 3 | 5 | 2303 |
| Chinese Academy of Fisheries Sciences | 3 | 3 | 718 |
| State Council Ministries | 7 | 8 | 3227 |
| Marine Educational Institutions | 9 | 18 | 4610 |
| Marine Management Agencies | 15 | 16 | 86 |
| Coastal Provinces and Municipalities | 12 | 19 | 1420 |
| Total | 57 | 93 | 17196 |

(UNCLASSIFIED)

Table 2. Ocean Sciences Related State Key Laboratories

| Parent Organization | Laboratory Emphasis and Key Scientists |
|---|--|
| Acoustics Institute, Beijing | Marine Acoustics (Professor Zhang Renhe) |
| Institute of Geology, Lanzhou | Gas Geochemistry - Global Change Environment |
| Naval Architecture and Ocean Engineering Research Center Shanghai Jiaotong University | Ocean Engineering |
| Institute of Atmospheric Physics, Beijing | Atmospheric Science and Geophysical Fluid Dynamics Numerical Modeling (Zeng Qingcun) |
| Xian University of Electronic Science and Technology | Radar Signal Processing (COSTIND) |
| Harbin Shipbuilding Engineering Research Institute | Modern Technology for Sonar Engineering (Professor Yao Lan) Properties of Underwater Military Targets (Wang Zhicheng) |
| Shanghai Institute of Technical Physics | Infrared Physics (Shen Xuechu) |

UNCLASSIFIED

Table 3. Chinese Society of Oceanography

Technical Subspecialties (18)

Air-Sea Interaction
Chemical Oceanography
Coastal Estuary
Coastal Zone Development and Management
Law of the Sea
Marine Biological Engineering
Marine Economy
Marine Environmental Science
Marine Geology
Marine Investigations
Marine Observation Technology
Marine Physics
Ocean Engineering
Remote Sensing
Sea Ice
Sea Water Desalination and Reuse
Storm Surge and TSUNAMI
Tides and Sea Level

Regions (7)

Beijing
Fujian
Guangdong
Guangxi
Liaoning
Shanghai
Zhejiang

Comment: The Chinese Society of Oceanography has some 11,000 members. The director, Yan Hongmo is currently the Director-General of the State Oceanic Administration.

UNCLASSIFIED

R&D capabilities could result from its investment in specialized laboratories and competitive funding of basic research. The relatively new funding vehicle for this investment is the National Natural Science Foundation (NNSF). The ocean-sciences related institutes identified to date have research emphasis in marine acoustics, sonar engineering, underwater military targets, geophysical fluid dynamics, global change and experimental marine biology (Table 2). The institutes will be importing equipment through one of over 200 large capital projects costing some thirty billion U.S. dollars over 1993-2000. It is expected that part of their staffing will consist of experienced researchers from abroad, who are expected to help bring Chinese

expertise to world-class levels.

(U) China's Society of Oceanography displays a defined set of technical subspecialties and regional groupings (Table 3). Although this professional society might be expected to be part of the CAS, it, in fact, belongs to the SOA. The association of the Society of Oceanography with the SOA, and the fact that the SOA also operates a command center for planning, management and routine support of ships and planes, suggests an enhanced status of the SOA relative to the CAS, at least in the field of ocean sciences. Also, most of the organizational activity in ocean sciences chronicled since 1978 involves the SOA (Table 4).

Table 4. Chronology of Organizational Ocean Science Events

| <u>Yr/Mo</u> | <u>Event</u> |
|--------------|--|
| 78/00 | <p>Shanghai Typhoon Research Institute is founded.</p> <p>Xiamen University Institute of Subtropical Oceanography is founded.</p> <p>Dalian Maritime University Institute of Ocean Engineering is founded.</p> <p>China Ocean Press is founded.</p> <p>Chinese Academy of Sciences (CAS) Institute of Acoustics begins actively promoting international exchange and cooperation.</p> <p>PRC marine science delegation comes to U.S. and visits every major oceanographic research institution to collect information and promote trade.</p> |
| 79/00 | <p>Fujian Institute of Oceanology is founded.</p> <p>Institute of Marine Geology is founded.</p> <p>Chinese Society of Oceanography is founded.</p> |
| 80/00 | <p>Founding of Ningbo Oceanographic Professional School, a special secondary school under the National Bureau of Oceanography (NBO).</p> |
| 82/00 | <p>China National Offshore Oil Corp. (CNOOC) is set up to coordinate exploration of South China Sea.</p> |
| 83/00 | <p>Shanghai Offshore Engineering Co. (SOECO) is set up under China State Shipbuilding Corporation (CSSC) to accelerate development of offshore oil industry. This is the first PRC corporation for designing and engineering offshore platforms.</p> |
| 84/00 | <p>China Offshore Oil Exploration and Development Research Center (COOEDRC) set up to advise China National Offshore Oil Corp. (CNOOC) on technical problems, new technologies, training and foreign cooperation.</p> |
| 85/00 | <p>Xiamen Oceanic Administration is established with headquarters at Third Institute of Oceanography. This regional administration is responsible for law enforcement, pollution and dumping control, and administration of coastal waters along Fujian Province and the Taiwan Straits.</p> <p>SOA South China Sea Branch begins actively promoting international contacts in marine science and technology.</p> <p>National Bureau of Oceanography (NBO) name is changed to State Oceanic Administration (SOA). Note that the old name will often still be used.</p> <p>China completes two-year scientific expedition to Antarctica qualifying it to become a full member of the Antarctica Treaty.</p> |
| 86/00 | <p>Nanjing University establishes Marine Sciences Center.</p> <p>CAS Institute of Acoustics initiates annual international acoustic conferences.</p> <p>Chinese Scientific Committee on Antarctic Research is founded (oversight group for National Committee on Antarctic Research).</p> |
| 87/00 | <p>State Science and Technology Commission (SSTC) approves setting up the SOA Institute for Marine Development Strategy with divisions for law of the sea, marine policy, marine economics and marine environment. This institute has explored China's claim to sovereignty beyond 200 miles to the edge of the continental shelf.</p> |

UNCLASSIFIED

Table 4. Chronology of Organizational Ocean Science Events (continued)

| Yr/Mo | Event |
|-------|--|
| 88/00 | <p>Dalian Institute of Ocean Meteorology is reorganized into three divisions: Ocean Weather, Applied Meteorology and New Technologies Application.</p> <p>Planned completion date for Science and Technology Information Institute in Tianjin for the SOA and the State Oceanographic Data Center. Computerized data banks for maritime environment, environmental protection defense and other information.</p> <p>Advanced remote sensing experimental center opens in Changchun. The center occupies a large 300 sq. km area with one of four large test sites in the coastal area at the mouth of the Liaohe River.</p> |
| 89/00 | <p>National marine newspaper in Beijing CHINA OCEAN NEWS begins publication.</p> <p>Polar Research Institute of China is founded under the National Committee on Antarctic Research (NCAR).</p> <p>Planes and Ships Command Center is set up. The Command Center is based on the former SOA Investigation and Command Department with responsibility for annual planning of planes and ships, their navigation and communications, and routine communications support for various SOA stations, Antarctic research stations, as well as ships and planes at sea.</p> |
| 90/00 | <p>State Council approves founding of China Marine Goods and Materials Corporation to manage goods and equipment planned for the nation's ocean community. This Corporation's management duties include sale of China's ocean instrumentation, importing marine research and engineering equipment, and participating in developing China's coastal zone and islands.</p> <p>Chinese and Soviet scientists sign five-year bilateral agreement for cooperation in ocean studies including marine physics and geology. The agreement, negotiated by the Chinese SOA and the Soviet State Committee for Science and Technology (GKNT), also mentioned the northwest Pacific and Kuroshio Current as areas of mutual interest.</p> |
| 91/01 | <p>National Center for Oceanographic Standards and Metrology begins formal operation following split from its parent organization, Institute of Ocean Technology in 1989.</p> |
| 91/04 | <p>China Ocean Minerals Research and Development Association (COMRA) begins formal operation after receiving UN approval to develop international sea floor mineral areas.</p> |
| 92/02 | <p>Beijing passes law reinforcing its claim to vast territorial waters. This law requires ships passing through territorial waters to obey PRC regulations, including surfacing of submarines and avoidance by aircraft. The area includes the Spratly and Paracel Island groups in the South China Sea.</p> |
| 93/07 | <p>SOA, for many years under the State Council, comes under the authority of the SSTC in mid-1993.</p> |
| 93/10 | <p>China releases "National Plan for Maritime Development." The SOA-sponsored work of 21 ministries and bureaus, PLA NAVY and 12 coastal provinces (three years in the making) sets out the country's overall maritime development from 1993 to 2020.</p> |
| 93/11 | <p>SOA begins trial operation of CHANGHE-2 long-range navigation and positioning system covering China's 18,000-km coastline from the Sea of Japan to the Spratlys and out to 1000 nautical miles offshore.</p> |

UNCLASSIFIED

~~(C)~~^U Chinese military-related R&D can occur in a variety of organizational settings. [REDACTED]

[REDACTED] NNSF funding includes support of naval R&D, such as a theoretical study of submarine target strength at the University of Electronic Science and

Technology in Chengdu. [REDACTED]

[REDACTED] PLA Navy research organizations include the Naval Research Center in Beijing for strategic planning and new weapons system design, and the Marine Survey and Cartography Research Institute which has developed a marine gravity database.

Section III

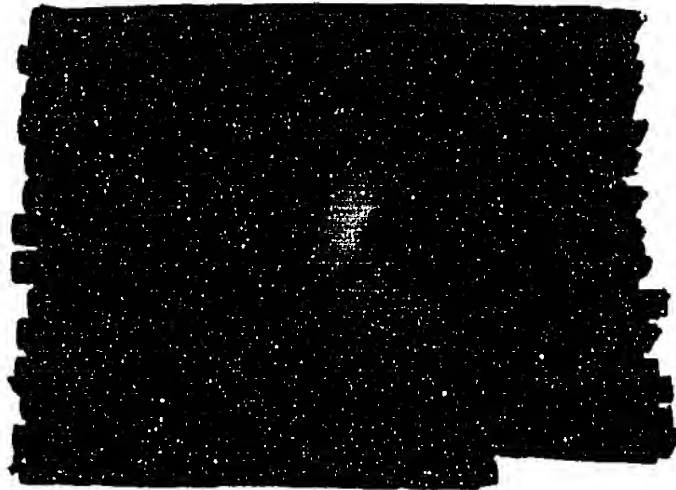
Oceanographic Research

(U) Like most scientific research in the Peoples's Republic of China (PRC), oceanographic research activities are under state control and therefore are associated with national economic policies and state plans. Despite a loosening of central government control along with the promotion of economic reforms and market-driven activity, research by individual scientists with independent funding is still very limited and usually carried out only to solve specific applied problems. Consequently, Chinese scientists have learned to wait for the government to set research topics. When research priorities are announced, there is often repetition and wasted effort as institutes and scientists throughout the country may concentrate on the same areas. Despite these drawbacks, China has done extensive research in oceanography, including those aspects critical to antisubmarine warfare (ASW). Attempts are being made to strengthen certain research areas by competitive funding practices, as noted in Section II.

Underwater Acoustics

(U) The Yellow, East and South China Seas on China's eastern coast are shallow water areas where the bottom plays a significant role in sound propagation. The Chinese Academy of Sciences' (CAS) Institute of Acoustics in Beijing is the center for much of China's published marine acoustic research, including both theory and experiments and experimental applications. China's shallow water acoustic modeling capability is similar to that of the U.S., although the actual implementation of the models is hampered by a lack of computer capability. Research on acoustic propagation in a shallow ocean waveguide has been led for many years by Zhang Renhe. Overall the PRC has a broad program in underwater acoustics which provides information

necessary for conducting ASW, but which is also useful for searching the sedimentary bottom for oil and gas deposits.



(U) Table 5 lists known Chinese acoustics researchers, their scientific specialty, and the organizations for which they work.

Physical Oceanography

(U) Chinese research in physical oceanography encompasses all areas including waves, tides, currents, ocean circulation, and physical properties of seawater. While most of this research has involved shallow coastal waters, there is growing interest in open ocean waters and polar waters of the Arctic and surrounding Antarctica. Most of the published research in physical oceanography appears to originate in a small number of institutes near Qingdao, including the First Institute of Oceanography, the Institute of Oceanology, and the Ocean University. Other research also has been conducted by Shanghai Jiaotong University, the Institute of Mechanics in Beijing, the Second Institute of

Table 5. PRC Ocean Acoustics Personalities

| Scientist | Speciality |
|-------------------------------------|---|
| <u>Acoustics Institute, Beijing</u> | |
| Cai Shaofan | Hydroacoustic techniques |
| Cao Nianfu | Hydroacoustic transducers |
| Chen Mingzhen | Hydroacoustic electronic techniques |
| Chen Shouliu | Piezo-electricity |
| Ding Dong | Hydroacoustic physics |
| Feng Peiyuan | Hydroacoustic physics |
| Feng Shaosong | Hydroacoustics |
| Gao Tianfu | Hydroacoustics-theory and experiments |
| Guan Dinghua | Hydroacoustics, electronics |
| Hang Ruheng | Hydroacoustics, instrumentation, data processing |
| Hou Chaohuan | Hydroacoustic physics, signal analysis |
| Hou Ziqiang | Hydroacoustic engineering, digital signal processing |
| Huang Zengyang | Signal processing, sonar systems design |
| Hu Zongzao | Computers |
| Jiang Jiping | Sound propagation |
| Li Qihu | Hydroacoustic signal processing |
| Pan Laixing | Acoustics, electronic information |
| Qian Zuwen | Acoustics |
| Qiu Xinfang | Hydroacoustic physics |
| Ren Shuchu | Transducers and arrays |
| Shang Erchang | Acoustics, marine physics |
| Shen Zhihua | Hydroacoustic engineering, radio techniques |
| Sun Yungong | Hydroacoustic signal processing |
| Tang Yingwu | Hydroacoustic physics |
| Tao Duchun | Underwater noise |
| Wang Dezhao | Physics, acoustics |
| Wu Chengyi | Hydroacoustic physics |
| Xiang Dawei | Hydroacoustic engineering and signal detection |
| Xu Qichang | Acoustic transducers |
| Xu Weiyl | Acoustic measurement and standardization |
| Xu Zhenxia | Hydroacoustic engineering, nonlinear acoustics |
| Xu Zhenyong | Hydroacoustic physics, signal analysis |
| Yang Shiqing | Managing scientific research, radio communications |
| Zhang Renhe | Hydroacoustic theory and experiments |
| Zhang Shuying | Underwater acoustics, hydroacoustic signal processing |
| Zhou Jixun | Marine acoustics |
| Zhou Zhiyu | Shallow water sound propagation, bottom acoustics |
| Zhu Weiqing | Hydroacoustics |
| Zhu Ye | Hydroacoustic signals and processing |

UNCLASSIFIED

Table 5. PRC Ocean Acoustics Personalities (continued)

| Scientist | Speciality |
|--|-----------------------------|
| <u>Fifteenth Institute, Seventh Academy, CSSC, Zhejiang Province</u> | |
| Gong Xianyi | Marine Acoustic Engineering |
| Liu Meng'an | Marine Acoustic Engineering |
| <u>Harbin Shipbuilding Engineering Research Institute, Harbin</u> | |
| He Zhayong | Hydroacoustics |
| Hui Junying | Hydroacoustic transducers |
| Jiang Nanxiang | Hydroacoustic transducers |
| Xiang Shimao | Hydroacoustics |
| Yao Lan | Hydroacoustic engineering |
| Zhou Fuhong | Hydroacoustic transducers |
| <u>Institute of Ocean Technology, Tianjin</u> | |
| Li Yunwu | Hydroacoustics |
| <u>Ocean University of Qingdao</u> | |
| Lin Junxuan | Marine acoustics |
| <u>Wuhan Institute of Physics, Wuhan</u> | |
| Wei Baoye | Underwater acoustic imaging |
| Zhang Dejun | Underwater acoustic imaging |
| <u>Xiamen University, Xiamen</u> | |
| He Endian | Marine acoustics |
| Xu Tianzeng | Underwater acoustics |

UNCLASSIFIED

Oceanography in Hangzhou, and the National Marine Data and Information Service in Tianjin.

(U) Research topics in physical oceanography are wide ranging and include experimental investigation of internal waves, unified theory of waves and waves breaking on structures, and pressure-generated long waves and wind-wave generation (useful for understanding and modeling ambient noise in the ocean). Other topics involve the study of tides, tide surges and sea level, and ocean currents (including the Kuroshio) which influence sound propagation. Chinese

scientists also model ocean circulation, primarily in waters close to the PRC and in the Pacific Ocean. The data collected is used to study differences in density, salinity and temperature, all of which are necessary to determine the sound velocity profile needed in modeling sound propagation. Chinese physical oceanography also encompasses numerical modeling of coastal fronts and upwelling.

Chemical Oceanography

(U) Published research in chemical oceanography (for

[REDACTED]

waters close to China) deals primarily with sediment geochemistry with applications to developing a capability for extracting minerals from the sea. In addition, research into dissolved species of chemicals in seawater (which affect its physical properties), desalination, and anticorrosive coatings is conducted.

Biological Oceanography

(U) PRC research in biological oceanography emphasizes food supply and nutrition, including aquaculture, commercial fishing, fish genetics and breeding, and marine biotechnology. The CAS Institute of Oceanography in Qingdao operates the Experimental Marine Biology Laboratory headed by Zeng Chengkui.

Geological Oceanography

(U) A large part of China's geological oceanography research is related to oil and gas exploration, which inherently provides information on the acoustic properties of the ocean bottom. In a shallow water environment such as China's coastal region, the composition of the ocean bottom is critical in estimating propagation and acoustic sensor performance. The study of sediment slope stability undertaken by the South China Sea Institute of Oceanology involves an area of importance for offshore development and possible marine oil exploration.

Marine Meteorology

(U) The center for the study of marine meteorology in the PRC is the CAS Institute of Atmospheric Physics in Beijing. Other organizations include the Nanjing University Department of Atmospheric Science, Ocean University of Qingdao, National Research Center for Marine Environmental Forecasts, the CAS Institute of Geography Department of Climatology, the Shanghai Typhoon Institute, and Beijing University Department of Geophysics. Research undertaken in marine meteorology includes developing models to demonstrate the interaction between ocean heating and atmospheric circulation, prediction of storm surges and ocean waves, and precipitation forecasts. The sea surface temperature plays a crucial role because meteorological phenomena are primarily driven by heat exchange between the atmosphere and the oceans.

(U) The significance of meteorological research lies in its ability to produce reliable forecasts. The Chinese are placing particular emphasis on how the El Nino surface flow and the Kuroshio Current affect marine meteorology. PRC researchers likely are able to develop models that could be used to make reliable forecasts given sufficient computer capability. Model development in combination with improved computer resources will result in greater potential for producing reliable forecasts.

Section IV Remote Sensing

(U) Oceanographic remote sensing research and development supports submarine detection, ocean surveillance, tactical oceanography, and environmental security, as well as military meteorology. Table 6 lists Chinese organizations and researchers with remote sensing expertise.

(S) ^U During the first half of the 1980s China focused its remote sensing work on coastal zone (CZ) sensing and basic research (Table 7). The CZ work was conducted by the National Remote Sensing Center (NRSC) and the State Oceanic Administration (SOA). The basic ocean remote sensing research was conducted primarily at universities under the State Education Commission (SEC) and the Chinese Academy of Sciences (CAS).

was very similar to the NOAA series of polar orbiting weather satellites. Following the short operational lifetime (less than two months), a second satellite, the Feng Yun-1B, was launched in September 1990.

(S) ^U

The SOA also conducted sea ice monitoring in the Bohai Sea, and successfully tested oil pollution monitoring.

(S) ^U

This technique has potential application in rapid mapping of shallow coastal areas for navigation.

(S) ^U By September 1988, however, China had built and launched its first weather satellite in polar orbit. The Feng Yun-1A (Wind and Cloud) satellite

Table 6. (U) PRC Ocean Remote Sensing Organizations and Personalities

Beijing University
Cheng Jicheng

Pan Deyang

East China Normal University, Shanghai
Yun Caixing

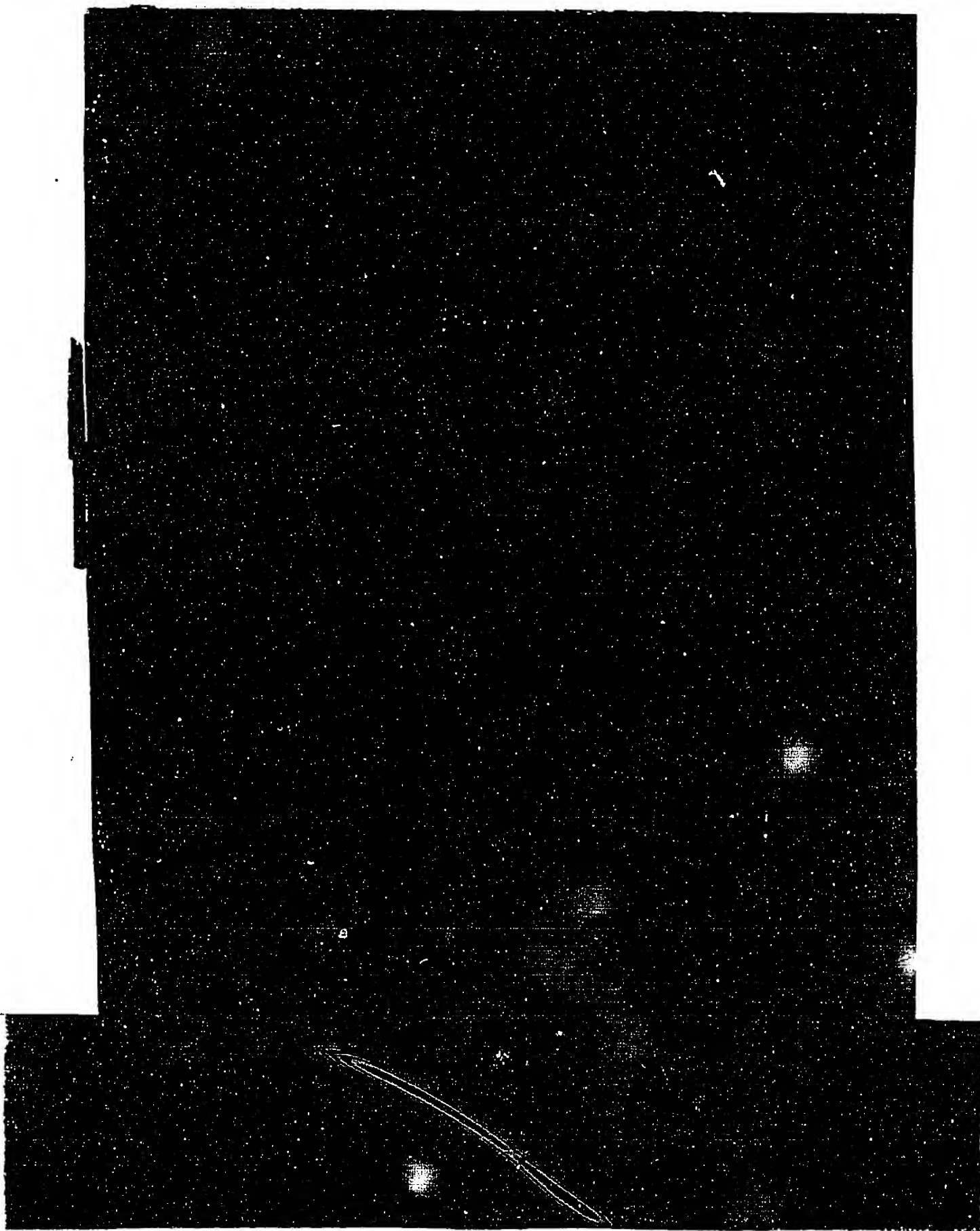
Institute of Ocean Technology, Tianjin
Liao Yunhe

Oceanology Institute, CAS
Ping Zhongliang
Satellite Meteorology Center
Chen Weiying
Zhang Lixia

Zhou Sisong

Shanghai Institute of Technical Physics
Gong Huixing

(U) In 1988, China announced the opening of a large experimental remote sensing center in Changchun, with a test area near the mouth of the Liaohe River on Bohai Bay. The CAS Institute of Geography, also in Changchun, has developed an airborne polarized multiband microwave radiometer used in dynamic monitoring of sea ice. It is not known to what extent this center will be involved in ocean remote sensing.



[REDACTED]

[REDACTED]

research on ocean color remote sensing, and satellite
oceanography information systems [REDACTED]

(S) China is working toward the establishment of an
Ocean High Technology Research Program by the SOA
and SEC involving microwave remote sensing, basic

Section V

PRC Research Ships and Operations (U)

(U) China's oceanographic community makes a distinction between survey/investigation and research. The Chinese are still using a three-stage methodology adopted in the 1950s, consisting of a large-scale multidisciplinary survey followed by successively smaller-scale and more sharply focused projects, generally concluding with longer-term specific tasks (Figure 3).

UNCLASSIFIED

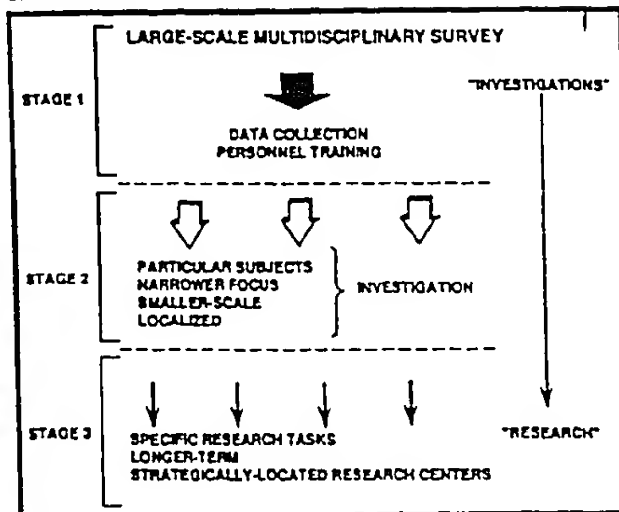


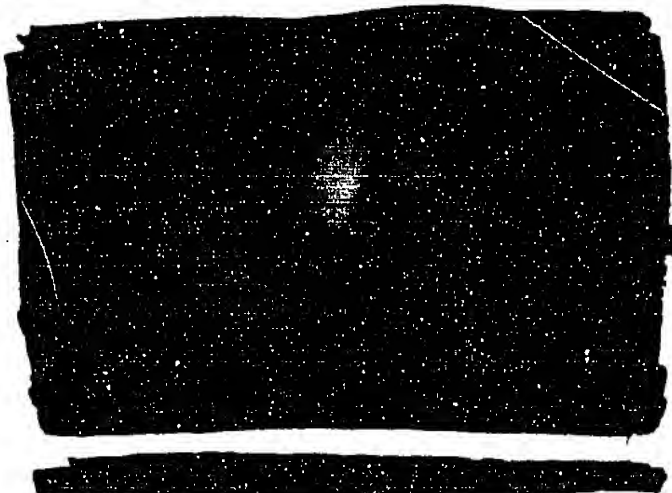
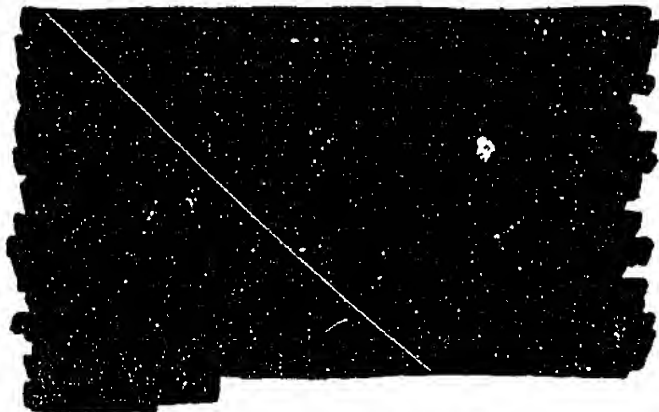
Figure 3. PRC marine scientific research methodology.

Antarctic expeditions have been conducted on an annual basis.

Over at least the last twenty years, the Chinese have released vast open source data on research ship activity. Appendix A provides a compilation of known PRC research ship characteristics, locations, and research emphasis.

Section VI Ocean Modeling (U)

(U) China's oceanographic and meteorological modeling capability can be viewed along two distinct lines: computing resources available and the quality and types of the models being run. Generally, the capability for operational modeling is only as good as the strength of the computing resources that can be applied to the problem. The numerical modeling of weather and ocean forecasting requires considerable computing power which has a direct affect on the accuracy, timeliness and forecast period of the model.



W
Experience in numerical modeling clearly exists in China. The IAP's Atmospheric Science and Geophysical Fluid Dynamics Numerical Modeling laboratory conducts research in all aspects of atmospheric and ocean modeling, simulation and forecasting.

W
(8) As noted in Section IV, the Chinese are developing a strong indigenous satellite remote sensing program.

Section VII

Ocean Sciences Data, Instrumentation and Technology Transfer (U)

Ocean Sciences Data (U)

(U) World Data Center D (WDC-D) was formally established in Tianjin in the late 1980s. WDC-D gives China the opportunity to exchange oceanographic data both with the United States (World Data Center A) and Russia (World Data Center B). WDC-D is composed of nine scientific sub-centers with computerized data banks containing information on the maritime environment, development, science, technology, the economy, petroleum exploitation, coastal power stations, transport, harbors, fisheries, salt production, environmental protection and national defense construction. The oceanology and meteorology subcenters are under the State Oceanic Administration (SOA) and Meteorology Bureau, respectively. The Chinese State Coordination Committee subordinate to the Chinese Academy of Sciences (CAS) is responsible for the coordination and liaison between China and the WDC-D, and for interaction and exchanges with other international and domestic organizations. Due to insufficient information, the quality and extent of China's oceanographic data are unknown and represents an intelligence gap.

(U) The CAS Acoustics Institute in Beijing, which has made significant contributions to the modernization of Chinese naval equipment, collects hydroacoustic data on China's shallow seas, the deep ocean area around the Spratly Islands, and China's open ocean areas. Other known data sources are the marine gravity database of the People's Liberation Army Navy Marine Survey and Cartography Research Institute, and a large amount of hydrometeorological data on the Spratly Islands from a recent navy project. The latter allows prediction of ocean weather conditions to determine the most favorable time to conduct marine operations in the

vicinity of the Spratly Islands.

Instrumentation and Technology (U)

(U) In a 1994 survey of technology employed for oceanographic research and investigation in China, the SOA's Institute of Ocean Technology noted the following inventories:

- a fleet of at least 55 research ships
- a national buoy network of 15 moored surface data buoys, imported and Chinese-made (FZS1-1)
- subsurface mooring system (with plans to develop a mooring system capable of operating at 6000 m depth)
- over 300 land-based and offshore platform-based coastal stations
- remote sensing aircraft and satellite
- submersibles
- various shipboard instruments which include:
 - model SZC4-1 STD system
 - GEK current meter
 - model SBA3 coastal acoustic wave gauge
 - model SBF1-1 wave buoy
 - model SCA2-2 tide gauge
 - geophysical instruments such as echo-sounder, side-scan sonar, gravimeter and proton magnetometer
 - model GPY precision sub-bottom profiler
 - model DDC-1 bottom profiler
 - MBSP acoustic system for nodule exploration
 - calibration equipment

(U) The Chinese are also investigating newer technologies such as fiber optic hydrophones, parametric sonars, ferrofluid transducers, and digital technology. During the 1980s, Chinese engineers at the Harbin Shipbuilding Engineering Research Institute developed and tested a prototype ferrofluidic transducer using a prototype developed earlier in the United States. The

[REDACTED]

prototype they produced showed that the Chinese are capable of doing considerably more than reverse engineering. The ferrofluidic transducer can be used in minesweeping, noisemaking and noise suppression applications. Other research includes the successful testing of a towed array of cylindrical hydrophones, a fiber-optic hydrophone and probably a lidar suitable for remote sensing of subsurface water temperature. Digital technology is being incorporated into instruments for measuring ocean wave heights and subsurface currents.

(U) A number of techniques relevant to remote sensing of the sea surface have been published in the open literature. The People's Republic of China (PRC) appears to be developing more sophisticated techniques for sonar target detection in the presence of interfering noise sources and complex multipath arrivals. China has also begun to consider neural networks for applications in acoustic signal processing, along with microprocessors for use in radars for sea surface remote sensing.

Technology Transfer (U)

[REDACTED]

[REDACTED]

[REDACTED] China is also using global scientific conferences as a means to acquire foreign marine scientific technology.

[REDACTED]

Section VIII

International Cooperation and Exchange Program (U)

(U) The People's Republic of China (PRC) has been involved in numerous ocean sciences-related international cooperation and exchange programs since about 1978. The State Oceanic Administration (SOA) and the Chinese Academy of Sciences (CAS) has primary control over the management of these programs. Selected marine sciences institutes subordinated to the SOA and CAS that are involved in international cooperation and exchange programs are noted in Table 8.

(U) In June 1986, China (through the SOA) signed an accord with the Federal Republic of Germany in an effort to boost bilateral cooperation on the development of ocean science and technology. The agreement included studies on maritime and seabed resources, pollution monitoring and protection, and deep-water technology. Information exchanges, visits by Chinese scientists and experts, and the convening of seminars and conferences were also part of the accord. The two parties established

Table 8. International Cooperation and Exchange:
Selected Marine Science Institutions of China

Chinese Academy of Sciences (CAS)

| <u>Institution</u> | <u>Cooperation and Exchange Activity</u> |
|--|---|
| Institute of Acoustics, Beijing | Active visitor exchange program since 1978 Holds annual international conferences in China since 1986 Push for international cooperation toward developing new techniques and high tech products |
| Institute of Atmospheric Physics, Beijing | Study of carbon dioxide induced climatic change (US) Diffusion of atmospheric pollutants over complex topography (US) Release of reducing gas from swamps (Germany) |
| Institute of Oceanography, Qingdao | Active visitor exchange program since 1979 South Yellow Sea circulation and sedimentation (US) Conference topics include phycology, economic sea weeds, sea level changes, effect of Pacific circulation on the China coastal current |
| Guangzhou Institute of Energy Resources, Guangzhou | Maintains contacts with UK, Japan, and Portugal |
| South China Sea Institute of Oceanography, Guangzhou | Quaternary sedimentation processes in the South China Sea (Germany) |

UNCLASSIFIED

**Table 8. International Cooperation and Exchange:
Selected Marine Science Institutions of China (continued)**

State Oceanic Administration (SOA)

| <u>Institution</u> | <u>Cooperation and Exchange Activity</u> |
|--|--|
| North Sea Branch, Qingdao | First Global GARP Experiment (FGGE) and tropical winds observation with R/V Xiangyanghong No. 9, 1978-1979, sponsored by World Meteorological Organization (WMO) Kuroshio research, twice yearly 1986-1992, with R/V Xiangyanghong No.9 (Japan) |
| East Sea Branch, Shanghai | FGGE in 1978 with R/V Shijiang Kuroshio survey (Japan) Marine pollution seminar (Denmark) Seminar on control of waste dumping at sea (IMO) |
| South Sea Branch, Guangzhou | Active visitor exchange program mainly since 1985 (US, UK, Canada and Japan) Buoy wave measurement and analysis in Beibu Gulf area of South China Sea, 1985-1987 (Hong Kong University of Science and Technology) Air-Sea interaction studies in tropical West Pacific, 1986-1990, 8 cruises (NOAA) |
| National Research Center for Marine Environmental Forecasting, Beijing | Member of IOC/WMO Integrated Global Ocean Services System (IGOSS) Western Pacific Ocean research (US) Kuroshio research (Japan) |
| National Marine Data and Information Service, Tianjin | Contacts with US, UK, Japan, Canada, France, North Korea, Australia, Ecuador, Peru Cooperation with IOC/IODE, FAO, ASFIS, World Data Center-A, World Data Center-B Assistance in setting up China National Oceanographic Data Center (NODC) (US) Agreement concerning data from TOGA program (US NODC) Kuroshio investigation and joint atlas publication (Japan) Data exchange and tidal predictions (Ecuador, Peru) |
| National Center for Oceanographic Standards and Technology, Tianjin | Visitor exchange in 1983-1985 (US, Canada) 2 visitors in 1986 North Korea Work on calibration methods in air-sea interaction investigation as basis for future cooperation (US) |
| National Marine Environmental Monitoring Center, Dalian | Active visitor exchange program Biology and geochemistry in Changjiang River Estuary and offshore waters adjacent to East China Sea (France) Sea ice (Finland) Marine oil pollution environmental risk assessment (Belgium) Programs planned in marine environmental protection (US, Russia, North Korea) |
| First Institute of Oceanography, Qingdao | Active visitor exchange program Seven international projects underway since 1984: - TOGA program air-sea interaction in tropical West Pacific (US) - Kuroshio investigation (Japan) - Coastal zone geomorphology and quaternary geology (Japan) - Marine geology in Philippine Basin (Germany) - Geology and geophysics of South China Sea (France) - Geology/geophysics survey in East and South China Seas (Germany) - Pheromones of polychaetes (Germany) |

UNCLASSIFIED

**Table 8. International Cooperation and Exchange:
Selected Marine Science Institutions of China (continued)**

| <i>State Oceanic Administration (SOA)</i> | |
|--|--|
| <u>Institution</u> | <u>Cooperation and Exchange Activity</u> |
| Second Institute of Oceanography, Hangzhou | <p>Active exchange program since 1978 Major cooperative projects include:</p> <ul style="list-style-type: none"> - Investigation of routes for sea bottom cable laying in East China between Shanghai and Kagoshima (Japan) - 3 year sedimentation dynamics study at Changjiang River mouth and nearby continental shelf involving some 100 persons from 18 Chinese organizations and some 30 persons from 15 US organizations (US) - Biogeochemistry of Changjiang Estuary and adjacent coastal waters of East China Sea, 3 yr study (France) - Geophysical study in East China Sea east of 126° E, and in central and southern South China Sea (Germany) - 8 year study in East China Sea and areas south and east of Japan hydrology, chemistry, biology, etc. (Japan) - Tidal flat sedimentation, south Hangzhou Bay (Netherlands) - Antarctica: since 1984, 10 scientists have worked at the Australian Antarctic station and participated in related expeditions with Japan, US, New Zealand, Germany, and others |
| Third Institute of Oceanography, Xiamen | <p>Active cooperation and exchange program since 1978</p> <ul style="list-style-type: none"> - Marine enclosed ecosystem experiment (Canada) - Coastal Dynamic Geomorphology and sediment transport (UK) - Coastal Ecology and protection and management of coastal resources (UK) - Sedimentation in Changjiang River Estuary and adjacent continental shelf (US) - Marine geology and geophysics (Germany) - Kuroshio investigation (Japan) - Intercalibration of marine pollutants (IOC) - Antarctic (New Zealand, Germany) |
| Institute for Marine Development Strategy, Beijing | 2 year cooperation program relating to Pacific Ocean economic development (Russian Academy of Sciences Far East Branch Institute of Economic and International Problems of Ocean Development) |
| Institute of Ocean Technology, Tianjin | Currently emphasizing expert exchanges; future emphasis to be placed on cooperative research and techniques for marine environmental observations |
| Institute of Seawater Desalination and Multipurpose Utilization, Tianjin | <p>Visitor exchange program Working with US company to develop a seawater desalination unit by 1993</p> |

UNCLASSIFIED

a joint commission to supervise and guide the bilateral cooperation. Economic considerations are difficult to verify in this case, but it was noted in late 1993, that Germany had become China's major trading partner in Europe.

(U) Besides enhancing the PRC's oceanographic research and improving its international status, ocean

research cooperation may also serve to provide an opportunity for political rapprochement. An example of this was demonstrated during a 1991 Hangzhou symposium on physical and chemical oceanography in waters surrounding China which included both China and Taiwan scientists. In addition, an August 1993 agreement was signed between PRC (SOA Third Institute of Oceanography, Fujian Institute of

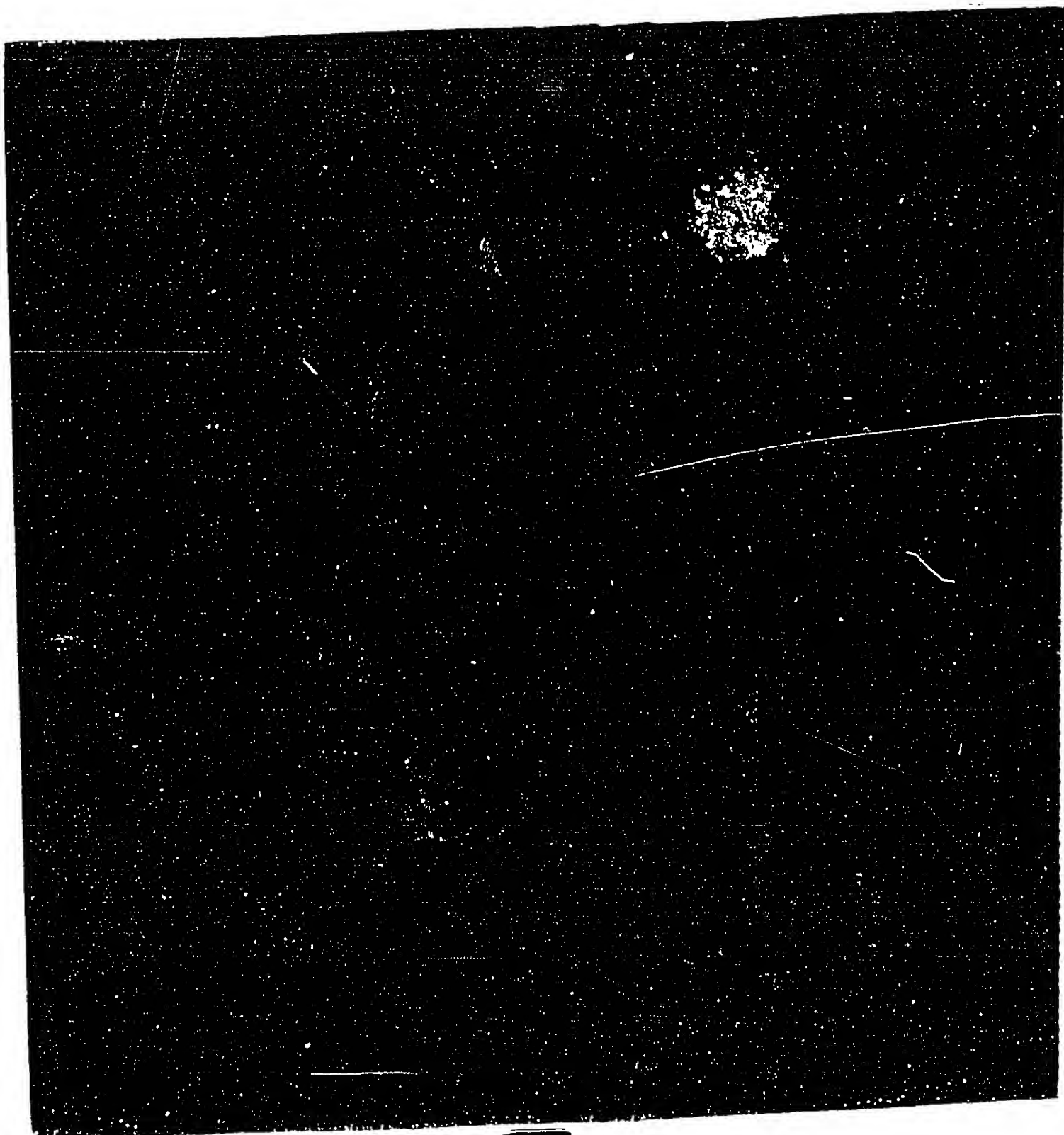
[REDACTED]

Oceanology, and probably the Institute of Subtropical Oceanography under Xiamen University) and Taiwan-supported oceanographic institutions. The PRC evaluated its own strengths to the partnership as "having an established research contingent, excellent basic theory, and deep and broad oceanology research." China saw Taiwan's strengths as "research funding, instruments and equipment, foreign contacts and personnel training." Also in 1993, China participated in a working group on marine scientific research in the South China Sea involving Brunei, Indonesia, Malaysia, the Philippines, Singapore, Taiwan, Thailand and Vietnam.

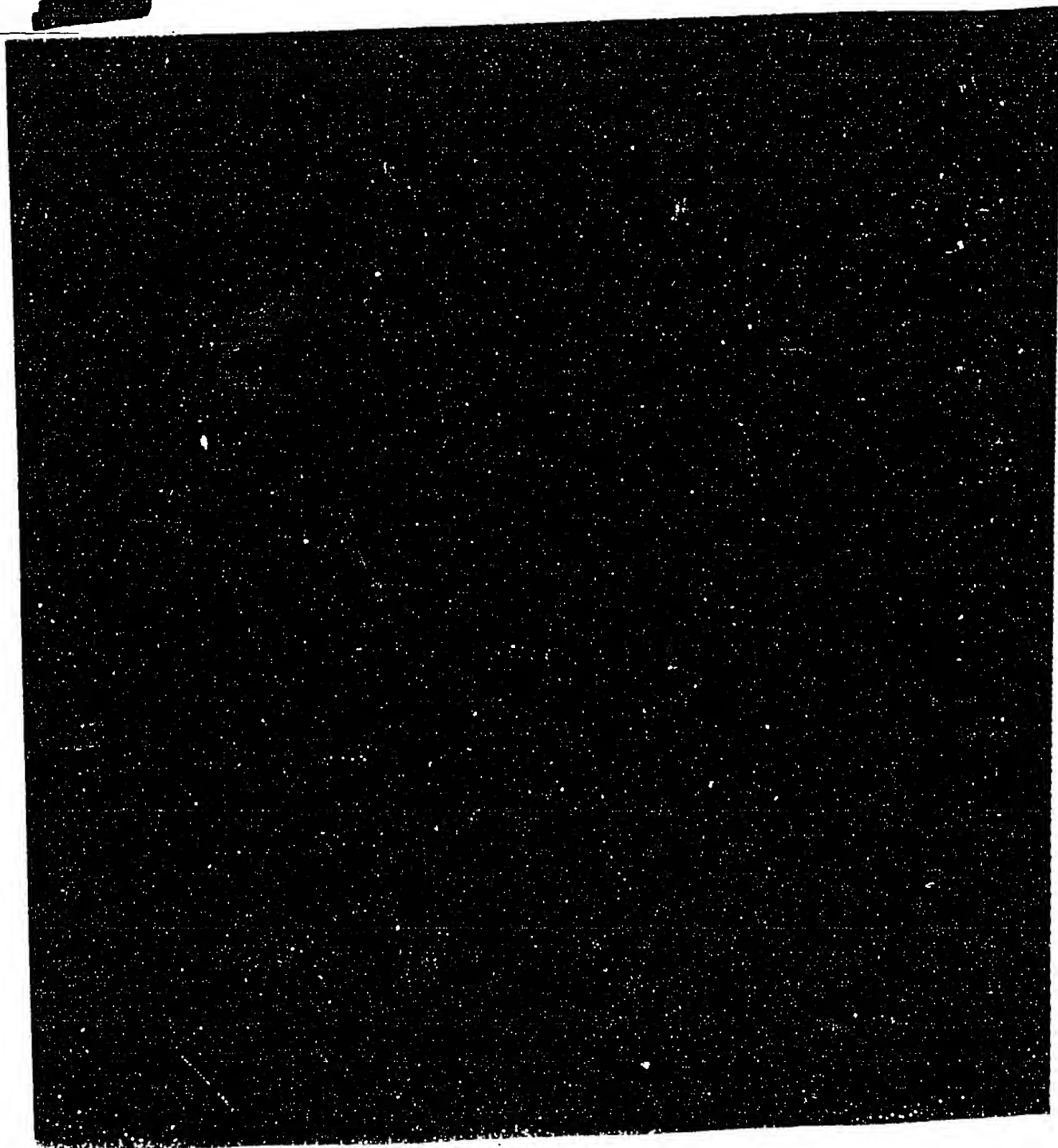
(U) The PRC and Russia have moved to reestablish scientific ties broken off in the late 1950s, including the signing of an agreement between the then-Soviet Far East Marine Zoology Institute and the CAS Institute of Oceanology. A bilateral agreement including

marine physics, geology, and instrumentation was to be implemented in 1991. This would mark an era of joint research over a five-year period based on the mutual interest of the two countries in the Northwest Pacific and Kuroshio Current.

(C) [REDACTED] The State Oceanic Administration has undertaken bilateral agreements with the DPRK involving the SOA's National Marine Data and Information Service, the National Center for Oceanographic Standards and Technology, and the National Marine Environmental Monitoring Center (the latter involving marine environmental protection). [REDACTED]



[REDACTED]



[REDACTED]

[REDACTED]

[REDACTED]

Appendix A (Continued)

PRC Research Ship Characteristics (U)
(Listed alphabetically by Class name)

PRC RESEARCH SHIP - BIN HAI 502 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1970 |
| Country Built | China |
| Homeport | Taku |
| # in Class | 2 |
| Length | 54.9 m |
| Beam | 8.5 m |
| Draft | 4.4 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - BIN HAI 506 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------------------|
| Ship Type | RES |
| Year Built | 1975 |
| Country Built | China |
| Homeport | Tianjin/ Tientsin |
| # in Class | 1 |
| Length | 68.5 m |
| Beam | 10 m |
| Draft | 3.5 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

Appendix A (Continued)

PRC RESEARCH SHIP - BIN HAI 511 CLASS (U)

| SHIP CHARACTERISTICS | |
|--|----------------------|
| Ship Type | RES |
| Year Built | 1978, 79 |
| Country Built | Japan |
| Homeport | Tianjin/ Tientsin |
| # in Class | 2 |
| Length | 79.1 m |
| Beam | 13.4 m |
| Draft | 4.6 m |
| Complement | 51 |
| Special Equipment: Helo pad [REDACTED] up to 3600 m; ice-breaking capability. | |

(U) BIN HAI 511 and 512 conduct geophysical research. They were designed for bathymetric and seismic research using satellite and terrestrial fixing. A helo pad was added in 1983.

PRC RESEARCH SHIP - BIN HAI 521 CLASS (U)

| SHIP CHARACTERISTICS | |
|---|----------------------|
| Ship Type | RES |
| Year Built | 1975 |
| Country Built | Japan |
| Homeport | Tianjin/ Tientsin |
| # in Class | 1 |
| Length | 51.2 m |
| Beam | 10 m |
| Draft | 3.6 m |
| Complement | Unknown |
| Special Equipment: ice-breaking hull and two diving chambers (Japanese ADS IV/KSWB-300) equipped with television cameras; seismic array, seafloor coring equipment. | |

(S) [REDACTED] Principle electronic instruments for this ship are made in Japan under U.S. patent. The ship has a seismic streamer and equipment for seafloor coring and sampling.

Appendix A (Continued)

PRC RESEARCH SHIP - DABNEY E PETTY CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------------|
| Ship Type | RES |
| Year Built | 1966 |
| Country Built | United States |
| Homeport | Shanghai |
| # in Class | 1 |
| Length | 48.8 m |
| Beam | 11.6 m |
| Draft | 3.1 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - DAJIANG CLASS (U)

| SHIP CHARACTERISTICS | |
|---|---------|
| Ship Type | RES |
| Year Built | 1980 |
| Country Built | China |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 156 m |
| Beam | 20.6 m |
| Draft | 6.1 m |
| Complement | Unknown |
| Special Equipment: Carries two helicopters. | |

(U) R-327 and YUAN WANG 3 are sister ships of submarine support and salvage ships.

Appendix A (Continued)

PRC RESEARCH SHIP - DING HAI CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | Unknown |
| Country Built | Unknown |
| Homeport | Unknown |
| # in Class | 2 |
| Length | Unknown |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) HAI SHENG 701 and 702 are subordinate to the State Oceanic Administration.

PRC RESEARCH SHIP - DONG FANG HONG CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------------------|
| Ship Type | RES |
| Year Built | 1965 |
| Country Built | China |
| Homeport | Qingdao/ Tsinglao |
| # in Class | 1 |
| Length | 85 m |
| Beam | 11 m |
| Draft | 4 m |
| Complement | 45 |
| Special Equipment: Unknown | |

(U) DONG FANG HONG is subordinate to the Academy of Sciences, Beihai Institute.

Appendix A (Continued)

PRC RESEARCH SHIP - DONG MING 01 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | Unknown |
| Country Built | China |
| Homeport | Qingdao |
| # in Class | 1 |
| Length | Unknown |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - DONG SHUI 1 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | Unknown |
| Country Built | China |
| Homeport | Unknown |
| # in Class | Unknown |
| Length | 32 m |
| Beam | 7 m |
| Draft | 3 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) XING HUO 1 is the only known ship in this class.

Appendix A (Continued)

PRC RESEARCH SHIP - FEN DOU ER HAO CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------|
| Ship Type | RES |
| Year Built | 1966 |
| Country Built | China |
| Homeport | Shanghai |
| # in Class | 2 |
| Length | 55.8 m |
| Beam | 9.2 m |
| Draft | 3.0 m |
| Complement | 20 |
| Special Equipment: Unknown | |

(U) FEN DOU Y1 HAO and FEN DOU ER HAO are subordinate to the Academy of Sciences.

PRC RESEARCH SHIP - FEN DOU 3 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------|
| Ship Type | RES |
| Year Built | 1979 |
| Country Built | China |
| Homeport | Shanghai |
| # in Class | 1 |
| Length | 68.4 m |
| Beam | 10 m |
| Draft | 3.1 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) FEN DOU SAN HAO is subordinate to the Academy of Sciences.

Appendix A (Continued)

PRC RESEARCH SHIP -FEN DOU 3 MOD A (U)

| SHIP CHARACTERISTICS | |
|----------------------------|-----------|
| Ship Type | RES |
| Year Built | 1979 |
| Country Built | China |
| Homeport | Guangzhou |
| # in Class | 3 |
| Length | 68.4 m |
| Beam | 10 m |
| Draft | 3.4 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) FEN DOU WU HAO, FEN DOU SI HAO, and SHI YAN 2 are subordinate to the Academy of Sciences, Nan Hai Institute.

PRC RESEARCH SHIP -FRANCESCO NULLO RESEARCH CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------------------|
| Ship Type | RES |
| Year Built | 1967 |
| Country Built | Poland |
| Homeport | Guangzhou/ Canton |
| # in Class | 1 |
| Length | Unknown |
| Beam | 19.5 m |
| Draft | 7.2 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

(S) XIANG YANG HONG 5 (XYH5) is subordinate to the State Oceanic Administration, Nan hai Branch. Built as a Polish B41 type ship in 1967, China purchased the ship from Poland and rebuilt it during the 1970-72 time frame.

Appendix A (Continued)

PRC RESEARCH SHIP -FS 330 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------------------------|
| Ship Type | RES |
| Year Built | Unknown |
| Country Built | United States |
| Homeport | 1 - Hudong 1 - Qingdao |
| # in Class | 2 |
| Length | Unknown |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - HAI BENG CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | Unknown |
| Country Built | Unknown |
| Homeport | Unknown |
| # in Class | 2 |
| Length | 29.3 m |
| Beam | 6.2 m |
| Draft | 2.7 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) The ships are HAI BENG and LIAO YUAN 2.

Appendix A (Continued)

PRC RESEARCH SHIP HAISHI CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | Unknown |
| Country Built | Unknown |
| Homeport | Unknown |
| # in Class | 3 |
| Length | Unknown |
| Beam | 7.6 m |
| Draft | 3.4 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - HUDONG CLASS (U)

| SHIP CHARACTERISTICS | |
|-------------------------------|---------|
| Ship Type | RES |
| Year Built | 1968 |
| Country Built | China |
| Homeport | Unknown |
| # in Class | Unknown |
| Length | 95 m |
| Beam | 17 m |
| Draft | 4.5 m |
| Complement | Unknown |
| Special Equipment: [REDACTED] | |

[REDACTED]

Appendix A (Continued)

PRC RESEARCH SHIP - HAI YANG 1 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|--|
| Ship Type | RES |
| Years Built | 1972-73 1980-81 |
| Country Built | China |
| Homeport | 2 - Guangzhou 1 - Shanghai 1 - Zhoushan/ Ting Ha 1 - Qingdao |
| # in Class | 7 |
| Length | 104.2 m |
| Beam | 13.7 m |
| Draft | 5 - 4.9 m 2 - 5 m |
| Complement | 101 |
| Special Equipment: Unknown | |

(U) HAI YANG 1 Class ships are:

[REDACTED]

(U) KE XUE YI HAO, HAI YANG 11, and HAI YANG 12 are subordinate to the Academy of Sciences, Nan Hai Institute.

[REDACTED]

According to Japanese open press, this ship has a 2x8x8 m device used to measure the temperature of the water discharged from vents in the ocean floor. The device is not tethered and is sound activated to rise and fall.

Appendix A (Continued)

PRC RESEARCH SHIP - HU KANG 102 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------|
| Ship Type | RES |
| Year Built | 1977 |
| Country Built | China |
| Homeport | Shanghai |
| # in Class | 1 |
| Length | 88.2 m |
| Beam | 14 m |
| Draft | 4.8 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - JIN XING CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------------|
| Ship Type | RES |
| Year Built | 1943 |
| Country Built | United States |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 45 m |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

Appendix A (Continued)

PRC RESEARCH SHIP - KAIBOKAN I CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | Unknown |
| Country Built | Japan |
| Homeport | Luda |
| # in Class | 1 |
| Length | Unknown |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) HAI SHENG 623 is subordinate to the State Oceanic Administration and assigned to the Northern Sea Fleet.

PRC RESEARCH SHIP - KAN CHA I CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1981 |
| Country Built | China |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 69.9 m |
| Beam | 10.5 m |
| Draft | 3.6 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

Appendix A (Continued)

PRC RESEARCH SHIP - KANGSU CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1972 |
| Country Built | Unknown |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 65 m |
| Beam | 9 m |
| Draft | 3 m |
| Complement | 120 |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - LADY ISABELLA CLASS (U)

| SHIP CHARACTERISTICS | |
|-------------------------------|---------|
| Ship Type | RES |
| Year Built | 1965 |
| Country Built | Germany |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 56 m |
| Beam | 10 m |
| Draft | 4 m |
| Complement | Unknown |
| Special Equipment: [REDACTED] | |

[REDACTED]

Appendix A (Continued)

PRC RESEARCH SHIP - MARINE NUMBER 4 (U)

| SHIP CHARACTERISTICS | |
|----------------------------|-----------|
| Ship Type | RES |
| Year Built | Unknown |
| Country Built | Unknown |
| Homeport | Guangzhou |
| # in Class | Unknown |
| Length | Unknown |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) In 1992, scientific exploration vessel MARINE NUMBER 4 participated in a 182 day natural resources exploration expedition in the North Eastern Pacific. The vessel took seabed pictures and collected polymetallic nodules to identify rich ore areas.

PRC RESEARCH SHIP - NAN HAI 502 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1979 |
| Country Built | Japan |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 65.7 m |
| Beam | 11.2 m |
| Draft | 4.4 m |
| Complement | 50 |
| Special Equipment: Unknown | |

Appendix A (Continued)

PRC RESEARCH SHIP - NAN HAI 503 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1979 |
| Country Built | Japan |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 75.9 m |
| Beam | 15 m |
| Draft | 4.6 m |
| Complement | 59 |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - PALLAS CLASS (U)

| SHIP CHARACTERISTICS | |
|--|----------------------|
| Ship Type | RES |
| Year Built | 1971 |
| Country Built | Finland |
| Homeport | Qingdao/ Tsingtao |
| # in Class | 1 |
| Length | 152.4 m |
| Beam | 20 m |
| Draft | 6.6 m |
| Complement | 129 |
| Special Equipment: JI DI HAO has ice-breaking capability as well as a small helicopter hangar and flight deck. | |

(U) JI DI HAO is subordinate to the National/State Bureau of Oceanography, Beihai Branch. JI DI HAO was ordered from Norway in 1983, and is similar to civilian research ships built for Mexico. JI DI HAO conducted its first cruise to the Antarctic and completed a round-the-world trip survey from 31 October 86 through 17 May 87.

Appendix A (Continued)

PRC RESEARCH SHIP - POOLE ANTELOPE MOD A CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------|----------------------|
| Ship Type | RES |
| Year Built | 1974 |
| Country Built | France |
| Homeport | Tianjin/ Tientsin |
| # in Class | 1 |
| Length | 74.9 m |
| Beam | 14.7 m |
| Draft | 3.2 m |
| Complement | 27 |
| Special Equipment: | [REDACTED] |

(S) [REDACTED]
Focus of operations has been on petroleum exploration in the Bo Hai Gulf.

PRC RESEARCH SHIP - SAN HANG ZUAN 2 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------|----------|
| Ship Type | RES |
| Year Built | 1976 |
| Country Built | China |
| Homeport | Shanghai |
| # in Class | 1 |
| Length | 40.6 m |
| Beam | 4.2 m |
| Draft | 2.1 m |
| Complement | Unknown |
| Special Equipment: | Unknown |

Appendix A (Continued)

PRC RESEARCH SHIP - SHIH YEN CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------------|
| Ship Type | RES |
| Year Built | 1950 |
| Country Built | United Kingdom |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 66 m |
| Beam | 11 m |
| Draft | 5 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) SHIH YEN (ex KIM GUAN) is subordinate to the Academy of Sciences. Formerly a coastal cargo steamer, it was converted for oceanographic duties in 1971.

[REDACTED]

PRC RESEARCH SHIP - SHIJIAN CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------|
| Ship Type | RES |
| Year Built | 1968 |
| Country Built | China |
| Homeport | Shanghai |
| # in Class | 2 |
| Length | 94.7 m |
| Beam | 14 m |
| Draft | 4.8 m |
| Complement | 115 |
| Special Equipment: Unknown | |

[REDACTED]

(U) Shijian operates in the Yellow and East China Seas and frequently carries scientists from the Academy of Sciences. In 1978 Shijian participated in the Fifth International Ocean and Development Conference at Tokyo and in the Global Atmospheric Research Program in 1979.

(U) SHIJIAN Class Kexueyihao was first seen in late 1989 and is a slightly modified version of Shijian.

[REDACTED]

Appendix A (Continued)

PRC RESEARCH SHIP - SHUGUANG 04 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Years Built | 1973-74 |
| Country Built | China |
| Homeport | Unknown |
| # in Class | 7 |
| Length | 59.5 m |
| Beam | 7.5 m |
| Draft | 2 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) The SHUGUANG Class ships are subordinate to the State Oceanic Administration.

PRC RESEARCH SHIP - SHUI XING CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------------|
| Ship Type | RES |
| Year Built | 1960 |
| Country Built | China |
| Homeport | Poss. Qingdao |
| # in Class | 1 |
| Length | Unknown |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) SHUI XING appears to be a general purpose oceanographic research ship subordinate to the Academy of Sciences, Beihai Institute.

Appendix A (Continued)

PRC RESEARCH SHIP - SHUGUANG (EX-SOVIET T-43) CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1970 |
| Country Built | China |
| Homeport | Unknown |
| # in Class | 3 |
| Length | 57 m |
| Beam | 8 m |
| Draft | 2 m |
| Complement | 80 |
| Special Equipment: Unknown | |

(U) The SHUGUANG Class was converted from ex-Soviet T-43 minesweepers in the late 1960s. One unit was used for hydroacoustic work.

PRC RESEARCH SHIP - U S OLYMPIC CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------------|
| Ship Type | RES |
| Year Built | 1966 |
| Country Built | United States |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 51.8 m |
| Beam | 14.3 m |
| Draft | 3.5 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

[REDACTED]

Appendix A (Continued)

PRC RESEARCH SHIP - XIANGYANG HONG 1 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|--------|
| Ship Type | RES |
| Year Built | 1970 |
| Country Built | China |
| Homeport | Ningbo |
| # in Class | 1 |
| Length | 65 m |
| Beam | 10 m |
| Draft | 3.5 m |
| Complement | 76 |
| Special Equipment: Unknown | |

(U) XIANGYANG HONG 1 (XYH1) works primarily as a meteorological research ship. It has physical oceanography, chemistry, and wave laboratories and carries armament. The name means "The East is Red."

PRC RESEARCH SHIP - XIANGYANG HONG 02 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|--------------------------------------|
| Ship Type | RES |
| Years Built | 1971-73 |
| Country Built | China |
| Homeport | 1-Guangzhou/ Canton 1-Shanghai |
| # in Class | 4 |
| Length | 73.8 m |
| Beam | 8 m |
| Draft | 3.3 m |
| Complement | 40 |
| Special Equipment: Unknown | |

(U) XIANGYANG HONG 02, 03, and 08 are subordinate to the State Oceanic Administration and are used as coastal survey ships.

Appendix A (Continued)

PRC RESEARCH SHIP - XIANGYANG HONG 04 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|-----------------------------|
| Ship Type | RES |
| Year Built | 1972 |
| Country Built | China |
| Homeport | 04-Shanghai 06-Guangzhou |
| # in Class | 2 |
| Length | Unknown |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) XIANGYANG HONG 04 and 06 are subordinate to the State Oceanic Administration.

PRC RESEARCH SHIP - XIANGYANG HONG 09 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|--|
| Ship Type | RES |
| Years Built | 1978, 1981 |
| Country Built | China |
| Homeport | 1-Qingdao/ Tsingtao(09) 1-Guangzhou/ Canton(14) 1-Shanghai |
| # in Class | 3 |
| Length | 122 m |
| Beam | 15.2 m |
| Draft | 1978 - 7.2 m 1981 - 5.2 m |
| Complement | 1978 Model - 147 1981 Model - 124 |
| Special Equipment: Unknown | |

(U) XIANGYANG HONG (XYH) 09, 14 and 16 (sunk 1993) are subordinate to the State Oceanic Administration.

(U) In May of 1993, XYH16 collided with a tanker and sank. It's homeport was Shanghai. This ship had an inverted "U" shaped stern boom, uncharacteristic of its class. It conducted yearly operations south of Hawaii from 1985-92 (less 89), which included oceanographic and mineral resource data collection. Also, XYH16 had conducted marine resource exploration in China's contiguous seas.

Appendix A (Continued)

PRC RESEARCH SHIP - XIANGYANG HONG 10 CLASS (U)

| SHIP CHARACTERISTICS | |
|---|----------------------|
| Ship Type | RES |
| Year Built | 1976 |
| Country Built | China |
| Homeport | Qingdao/ Tsingtao |
| # in Class | 1 |
| Length | 156.2 m |
| Beam | 20.6 m |
| Draft | 6.8 m |
| Complement | Unknown |
| Special Equipment: one SA-321G Super Frelon helicopter with hangar and landing deck; has ice-strengthened hull. | |

(U) XIANGYANG HONG 10 (XYH10) is subordinate to the State Oceanic Administration, Donghai Branch. Construction of this ship was completed in 1976. There are labs for hydrology, meteorology, acoustics, marine biology and chemistry. A helicopter hangar (for 1 SA-321G Super Frelon) and landing pad are located aft, and a large crane forward. (U) XYH10 conducts sonar testing, geomorphology, and geophysics research. Originally suited for all but Arctic conditions, XYH10 was reportedly rebuilt in 1984/85 as an Antarctic research and supply ship for the Great Wall Station and resupply Depot on South Georgia Island. It withstood "level 12" storms in the Antarctic in 1985.

PRC RESEARCH SHIP - YENLAI CLASS (U)

| SHIP CHARACTERISTICS | |
|---|-----------------------------|
| Ship Type | RES |
| Year Built | 1970s. |
| Country Built | Unknown |
| Homeport | 1 - Qingdao 2 - Zhonghua |
| # in Class | 3 |
| Length | 72 m |
| Beam | 9.8 m |
| Draft | 3 m |
| Complement | Unknown |
| Special Equipment: carries four survey boats. | |

Appendix A (Continued)

PRC RESEARCH SHIP - YENLUN CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1970 |
| Country Built | China |
| Homeport | Luda |
| # in Class | 1 |
| Length | 68.6 m |
| Beam | 19.4 m |
| Draft | 2.9 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) YENLUN Class HAITSE 583 has an open well deck aft for supporting diving equipment and deep ocean survey work.

PRC RESEARCH SHIP - YUAN WANG 1 CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1979 |
| Country Built | China |
| Homeport | Unknown |
| # in Class | 2 |
| Length | 187 m |
| Beam | 23 m |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

(U) YUAN WANG 1 and 2 are MASI astronomical survey ships. These ships have a helicopter platform, but no hangar.

(U) YUAN WANG 1 was fitted in 1987 with satellite navigation and new meteorological equipment. It assisted with the launch of an Australian satellite in August 1992. Its radar systems captured the target using the "digital direction" - "shuyin" method, conducted surveys, and took valuable photos of the satellite - all considered "breakthroughs" due to recent upgrades.

Appendix A (Continued)

PRC RESEARCH SHIP - ZHONGHUA CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1969 |
| Country Built | China |
| Homeport | Unknown |
| # in Class | Unknown |
| Length | 8.7 m |
| Beam | 14 m |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - ZIJANG CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|---------|
| Ship Type | RES |
| Year Built | 1970s. |
| Country Built | China |
| Homeport | Unknown |
| # in Class | 3 |
| Length | 94.7 m |
| Beam | 14 m |
| Draft | 4.7 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

Appendix A (Continued)

PRC RESEARCH SHIP - UNKNOWN CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|----------------------|
| Ship Name | BIN HAI 516 |
| Ship Type | RES |
| Year Built | 1970 |
| Country Built | United States |
| Homeport | Tianjin/ Tientsin |
| Length | 57.5 m |
| Beam | 11.5 m |
| Draft | 3.2 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

PRC RESEARCH SHIP - UNKNOWN CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|-----------------|
| Ship Name | JIN XING ER HAO |
| Ship Type | RES |
| Year Built | 1974 |
| Country Built | China |
| Homeport | Unknown |
| Length | 68.4 m |
| Beam | 10 m |
| Draft | 3.5 m |
| Complement | Unknown |
| Special Equipment: Unknown | |

Appendix A (Continued)

PRC RESEARCH SHIP - UNKNOWN CLASS (U)

| SHIP CHARACTERISTICS | |
|----------------------------|-----------------------|
| Ship Name | ZHONG GUO HAI JIAN 72 |
| Year Built | 1989 |
| Country Built | China |
| Homeport | Guangzhou/ Canton |
| # in Class | Unknown |
| Length | Unknown |
| Beam | Unknown |
| Draft | Unknown |
| Complement | Unknown |
| Special Equipment: Unknown | |

[REDACTED]

PRC RESEARCH SHIP - UNKNOWN CLASS (U)

| SHIP CHARACTERISTICS | |
|-------------------------------------|---------|
| Ship Name | HAISHEN |
| Year Built | Unknown |
| Country Built | China |
| Homeport | Unknown |
| # in Class | 1 |
| Length | 28 m |
| Beam | 8.8 m |
| Draft | Unknown |
| Complement | 96 |
| Special Equipment: small submarine. | |

(U) HAISHEN is China's first underwater scientific survey vessel. It was built at Qingdao Dongfeng Shipyard, China.

(U) HAISHEN carries a small submarine between its twin hulls. The submarine can carry 18 passengers and submerge to a depth of 70 m. It was designed for directing underwater engineering work, marine life and plant surveys.

Appendix A (Continued)

PRC RESEARCH SHIP - UNKNOWN CLASS (U)

(U) The following is a list of ships reported to be active in the PRC. However, no information is available on them at this time.

[REDACTED]